



18026 - Testing Volatile Transportation in the Epoch of Terrestrial Planet Formation

Cycle: 33, Proposal Category: GO
(Availability Mode: SUPPORTED)

INVESTIGATORS

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Dr. Cicero Lu (PI) (Contact)	NOIRLab - Gemini North (HI)
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Kadin Worthen (CoI)	Space Telescope Science Institute
Dr. Tracy Beck (CoI)	Space Telescope Science Institute
Dr. Aki Roberge (CoI)	NASA Goddard Space Flight Center
Prof. Kevin France (CoI)	University of Colorado at Boulder
Dr. John Henry Debes (CoI) (ESA Member)	Space Telescope Science Institute - ESA - JWST
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Dr. Bin Ren (CoI) (ESA Member)	Observatoire de la Cote d'Azur
Dr. Andre-Nicolas Chene (CoI)	NOIRLab - Gemini North (HI)

VISITS

<i>Visit</i>	<i>Targets used in Visit</i>	<i>Configurations used in Visit</i>	<i>Orbits Used</i>	<i>Last Orbit Planner Run</i>	<i>OP Current with Visit?</i>
01	(2) -BET-PIC WAVE	STIS/CCD STIS/NUV-MAMA	1	21-Jan-2026 05:00:14.0	yes
02	(1) HD-131488 WAVE	STIS/CCD STIS/NUV-MAMA	2	21-Jan-2026 05:00:15.0	yes
03	(3) HD-181327 WAVE	STIS/CCD STIS/NUV-MAMA	2	21-Jan-2026 05:00:16.0	yes

5 Total Orbits Used

ABSTRACT

Debris disks offer a unique laboratory to test theories of volatile transport in the epoch of terrestrial planet formation. The leading hypothesis posits that exocomets can deliver water-ice stored in exo-Kuiper belts and the inner regions of a young planetary system in the form of water vapor via sublimation. However, liquid water remains elusive in debris disks to date. We propose to observe OH fluorescence emission as a tracer for H₂O in liquid and vapor phases with HST STIS/NUV E230H and definitively to decipher whether water vapor exists in the inner regions in three young planetary systems (HD 131488, beta Pictoris, and HD 181327). These targets are most suitable because they contain water-rich exo-Kuiper belts newly discovered with JWST/NIRSpec observations and have also been identified with exocometary activities from past multi-wavelength studies. We aim to constrain the OH gas temperature, emission mechanism, and radial velocity for any detected OH line velocity to examine whether the OH gas origin is consistent with exocometary. While JWST provides new clues to the composition of planetesimal reservoirs, our proposed HST observation will provide the most direct and definitive clue for the existence of liquid H₂O in debris disks. A non-detection will allow us to place the first constraints on OH dissociation rates based on observed H₂O-ice column densities, providing a new benchmark for comparison with younger, gas-rich protoplanetary disks. Our proposed observation across our sample of early A to mid-F type stars will benchmark our understanding of the volatile transportation in these exoplanetary systems.

OBSERVING DESCRIPTION

We aim to observe 3 debris disks, beta Pictoris, HD 131488, and HD 181327 with STIS/NUV MAMA E230H/c3012 with longslits. The objective of this program is to detect OH molecules resulting from exocometary outgassing and/or photoevaporation from the surface of planetesimals.

Since beta Pic is very bright ($V \sim 3.86$), we follow previous successful observations from PID 14735 and choose to use the 31x0.05 NDA slit to prevent saturating the detector. For HD 131488 and HD 181327, we chose to use 6 x0.2 arcsec slits. In the phase I proposal stage, we specified that a

0.2x0.2 arcsec square slit, but we have now realized that 6 x0.2 arcsec is a better choice because the extent of the slit can capture the entire disk in the FOV.

Since we are using narrow slits with widths of 0.05 and 0.2, we add a acquisition/peak-up sequence after the standard acquisition (STIS-CCD) of the target to optimize the centering of the target in the slit. We also add a wavelength cal sequence prior to our science observation. For beta Pic, we use a 0.2x0.09 arcsec slit, and for the rest two, we use 0.2 x0.2 arcsec as recommended by HST/STIS docs for longslit echelle spectrograph (<https://hst-docs.stsci.edu/stisihb/chapter-12-special-uses-of-stis/12-2-long-slit-echelle-spectroscopy>).

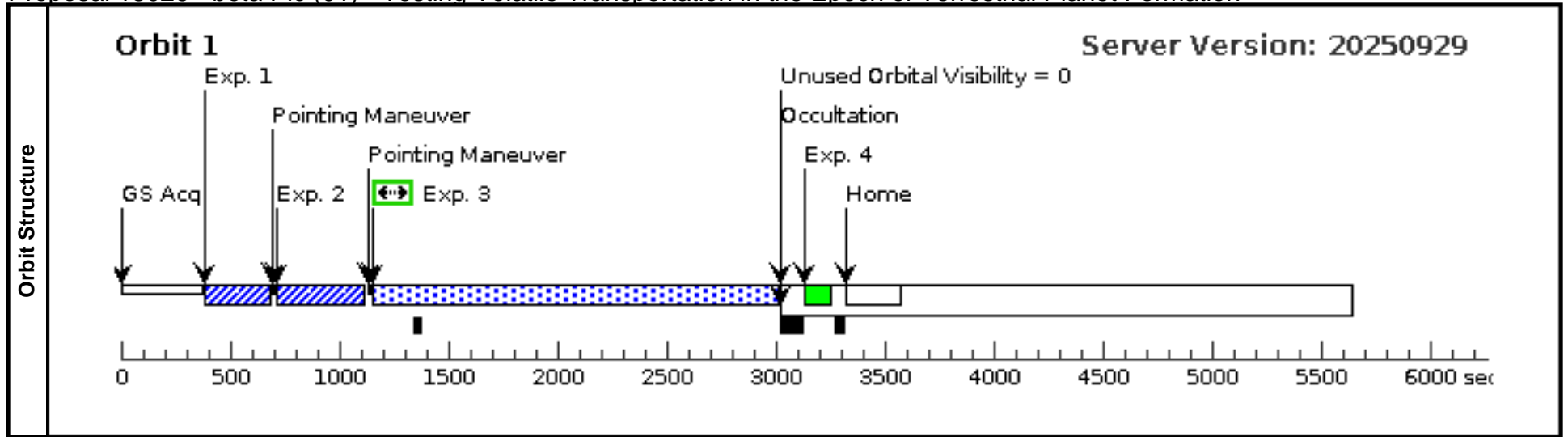
We plan to observe the beta Pic for 2210 seconds to achieve an SNR of 50. Similarly, we plan to observe 3695s for HD 131488 and 2600s for HD 181327. These numbers differ a little bit from our specified exposure in the phase 1 proposal (3875s, 1580s, and 1798s for HD 131488, HD 181327, and beta Pictoris) due to re-running the ETC. But the new numbers are still within the allocated 5-orbit limitation.

Additionally, we add position angle constraints to the science target to ensure alignment between the disk PA and slit PA. A misalignment between the two PAs will likely result in any possible emission falling outside of the slit.

Proposal 18026 - beta Pic (01) - Testing Volatile Transportation in the Epoch of Terrestrial Planet Formation

Wed Jan 21 10:00:16 GMT 2026

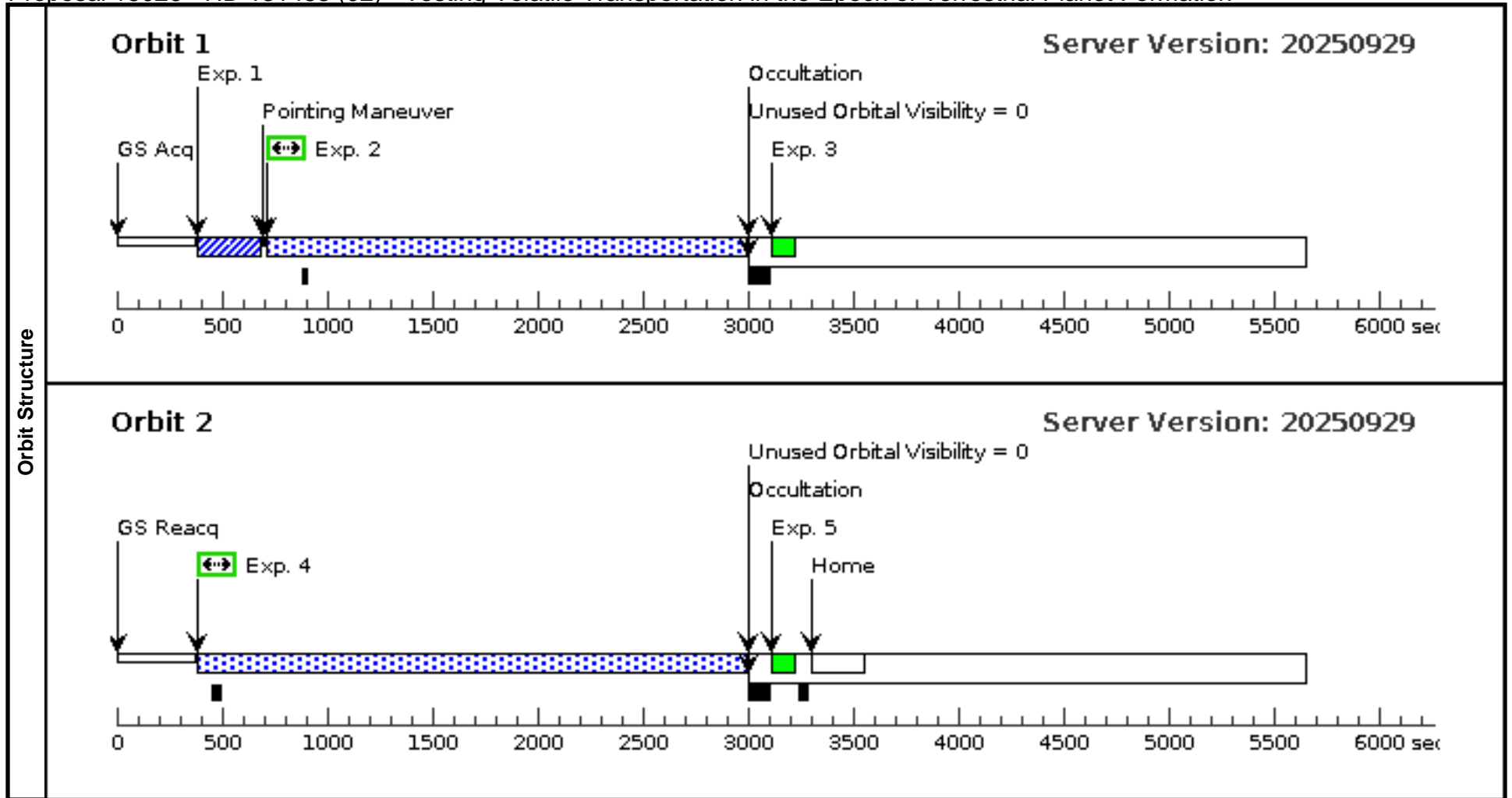
Visit	Proposal 18026, beta Pic (01), implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: ORIENT 75.8D TO 77 D; ORIENT 255.8D TO 257 D <i>Comments: The ETC gave a warning on buffer time being too short. Would this affect the science data? The STIS handbook says for a time-tag obs, the buffer time must be over 99 seconds. This observation is MAMA ACCUM mode, can we safely ignore the warnings? My alternative solution is to use 31x0.05NDC which would drop SNR by a factor of 2.5 but keep the buffer time long enough. Thank you for your time and help.</i>																																																											
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Proposal 18026 - HD 131488 (02) - Testing Volatile Transportation in the Epoch of Terrestrial Planet Formation

Wed Jan 21 10:00:16 GMT 2026

Visit	Proposal 18026, HD 131488 (02), implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: ORIENT 128D TO 136 D; ORIENT 308D TO 316 D									
	Fixed Targets	#	Name	Target Coordinates	Targ. Coord. Corrections	Fluxes	Miscellaneous			
		(1)	HD-131488	RA: 14 55 8.0288 (223.7834533d) Dec: -41 07 13.40 (-41.12039d) Equinox: J2000	Proper Motion RA: -18.399 mas/yr Proper Motion Dec: -22.27600002697727 mas/yr Parallax: 0.006568399999999999" Epoch of Position: 2000	V=8.0	Reference Frame: ICRS			
	<i>Comments: This object was generated by the targetselector and retrieved from the SIMBAD database. SIMBAD listed proper motion for this target. When retrieving targets with PM from SIMBAD, APT requests the coordinates be calculated with an epoch of the year 2000. Do not modify this epoch. Always review coordinates using the Target Confirmation tool, which graphically displays the PM.</i> Category=STAR Description=[A0-A3 V-IV, DISK]									
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	1	TA/ACQ (STIS.ta.202 5033)	(1) HD-131488	STIS/CCD, ACQ, F25ND3	MIRROR				1 Secs (1 Secs)	
									[==>]	[1]
	2	Science (STIS.sp.20 25038)	(1) HD-131488	STIS/NUV-MAMA, ACCUM, 6X0.2	E230H 3012 A	WAVECAL=NO			2111 Secs (2111 Secs)	
									[==>]	[1]
	3	WAVECAL E230H/c301 2	WAVE	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230H 3012 A				[==>]	[1]
4	Science (STIS.sp.20 25038)	(1) HD-131488	STIS/NUV-MAMA, ACCUM, 6X0.2	E230H 3012 A	WAVECAL=NO			2543 Secs (2543 Secs)		
								[==>]	[2]	
5	WAVECAL E230H/c301 2	WAVE	STIS/NUV-MAMA, ACCUM, 0.2X0.2	E230H 3012 A				[==>]	[2]	



Proposal 18026 - HD 181327 (03) - Testing Volatile Transportation in the Epoch of Terrestrial Planet Formation

Wed Jan 21 10:00:16 GMT 2026

Visit	Proposal 18026, HD 181327 (03), implementation Diagnostic Status: No Diagnostics Scientific Instruments: STIS/NUV-MAMA, STIS/CCD Special Requirements: (none)																																																																					
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